

project WEB


Winter
2009

Connecting Projects WILD, WET and Learning Tree in New Hampshire

Climate Change

Climate Change - the subject can provoke quite a debate. Even though there are many viewpoints on climate change, its potential impacts and what we can or should do about it, teachers and educators should not be afraid to tackle this important topic with students.

The Intergovernmental Panel on Climate Change has assessed the scientific, technical and socio-economic information worldwide, and has concluded that our climate is changing, and that change is a result of human activity.

Learning about the science of climate change and its impact on plants and animals is key to understanding what people are doing to make a difference and why. Students should ask critical questions of the science and explore how choices we make today may affect the future climate. 

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“As more and more people understand what’s at stake, they become a part of the solution, and share both in the challenges and opportunities presented by the climate crises.”

~ Al Gore



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The Changing Climate and Our Forests

By David Dobbs

Climate change will affect far more than tree species in the Northern Forest. It will likely have profound effects on the forest-based businesses and recreational activities that provide the economic and emotional richness so many of us who live here enjoy. An article of even twice this scope could not adequately address all the potential effects on the forestry and fishing, milling and mountain-climbing, biomass burning and birdwatching that characterize the region. Here, however, is a thumbnail digest of predicted effects as gleaned from the reporting for this story.

Woods business. Here a world of natural variables meets the unpredictability of human behavior. A few possibilities:

Changes in forest cover will push the paper industry toward a different mix of papers, as the size of the spruce and fir forest shrinks and is replaced

by hardwoods. But the relative abundance of water, which can be used both for power and as a necessary manufacturing ingredient, may actually make some papermaking more attractive. Small, smart, energy-savvy mills may find a way to do good business. While older Northeastern pulp mills will have a difficult time competing against Southern U.S. and South American mills, they may have a strategic advantage if cellulosic ethanol integrated with pulp making becomes a reality. The reason: no new pulp mills are likely to be built in the U.S., and it makes better sense to retrofit the older mills than the newer southern mills.

Biomass plants, meanwhile, may become more attractive since a wide variety of tree species can be burned, overall tree growth rates will probably rise, and renewable energy will become ever more desirable. This expanded market for wood could be good

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if it helps make it profitable to remove low-value wood as a key to forest management, but bad if it encourages over-harvesting or the conversion of diverse forest ecosystems into monoculture plantations.

The certainty of change means that the woods industry will need to adapt intelligently and flexibly. The ability to mill, manufacture, and market the full spectrum of species will be vital. The region's increasing wetness (and therefore productivity) might create possibilities not found in other parts of a country that will grow drier and hotter.

Sugaring. Research done by Tim Perkins at the University of Vermont's Proctor Maple Research Center has shown that the

average number of productive sugaring days in New England has decreased. Does this mean sugarmaking will eventually disappear? The hotter, faster models say yes. The others say: not completely. The concern is not so much that the maples will disappear as that the window of sugaring weather – nights in the 20s, days in the 40s – will shrink so much and become so erratic that the industry can't sustain itself. "There may be some hobbyists making maple syrup" in 100 years, said Perkins. "But it won't be made commercially."

Foliage. The future of leaf peeping is even more uncertain, for the relation between weather and foliage is poorly understood. Fall frosts, which play a key role in both the onset and vibrancy of fall foliage, will probably come later, but it's not known whether this will really affect color. And the color mix will be far different – pretty, though less so to many eyes – if the maples are replaced by oaks and hickories. Best guess: in 50 years, still ablaze; in 200, dimmer and duller.

Fishing. Even though overall groundwater supplies may be boosted by winter rains, the hotter, drier summer streams will stress fish of every species. Coldwater species – trout and salmon – will likely be driven to higher tributaries and to the few lakes deep enough to stay cool.

Hiking. Our alpine areas – those small but precious tundra zones atop our higher

ranges – may shrink to almost nothing. This would decrease biodiversity and dismay many hikers.

Skiing. Snow sports will suffer horribly. The leading models predict the snow season will shrink by 25 to 50 percent and be punctuated even more often by rain. A 100-day ski season is generally considered necessary for a profitable industry; ours will shrink to 50 to 75 days, and the temperatures will likely be too warm to augment the snowpack with snowmaking. "Only western Maine," concludes the NECIA report, "is projected to retain a reliable ski season."

Development pressure. With the rest of the country growing even hotter and drier, the pressure in the Northern forest for new houses and infrastructure will almost surely continue to increase. Boston and New York City, for instance, now experience 10 to 15 days per year with temperatures over 90°F; by 2100, they could have more than 2 months of weather that hot, with 14 to 28 days over 100°F. To urban residents, the North Woods may look better than ever.

Excerpted with permission from "Climate Change, Tree by Tree: How Would a Changing Climate Affect Our Forests?" by David Dobbs, from Northern Woodlands, Winter 2008. David Dobbs (<http://daviddobbs.net>) writes on science, nature and culture for the New York Times, Scientific American and other publications.



Activities Related to Articles in This Issue

Project Learning Tree suggests:

In *Our Changing World*, students explore connections among the world's natural resources, energy use and human activities by analyzing a global environmental issue.

Students explore how patterns of change affect the diversity of species on Earth in *Life on the Edge*. They will learn the habitat components that organisms need to survive, research an endangered or threatened species, and give a persuasive presentation on preserving what that organism needs.

In *The Global Climate*, students use data collected from Mauna Loa to graph changes in atmospheric levels of CO₂ and identify possible reasons for those changes. They will also learn about the relationship between CO₂ and the Earth's

climate and explore ways to reduce the amount of CO₂ they generate.

Project WET suggests:

In *A Drop In the Bucket*, middle school students estimate and calculate the percent of available fresh water on Earth. This helps them understand that water is a limited resource and must be conserved. (K-2 Option)

Students explore their feelings for an understanding of water-related topics through a variety of writing and reading activities in *Water Write*. (All ages)

In *Whose Problem Is It?*, middle and high school students analyze the scope and duration of a variety of water-related issues to understand the relationship between local and global issues.

Project WILD suggests:

Through research in *Here Today, Gone Tomorrow*, students become familiar with the designations of threatened, endangered and extinct as applied to wildlife species, and the factors that lead species into those designations.

Students investigate an area and use bird-counting techniques to inventory bird populations in an activity called *Bird Song Survey*.

In *Bottleneck Genes*, students simulate the gene-pool analysis of a population of black-footed ferrets using colored beads to demonstrate how natural selection favors individuals with traits adapted to their environment.

Green Slopes: Creating Environmentally Friendly Ski Slopes

Despite the outstanding snowfall in 2008, climate change is impacting the ski industry in New Hampshire in a big way. The seasons are becoming shorter and wetter, and New Hampshire facilities want to be known for extreme slopes and appealing atmosphere, not slushy skiing! To increase efficiency, the ski industry is increasing its environmental awareness, thus becoming stewards for reducing pollution. In 2007, the New Hampshire Pollution Prevention Program (NHPPP) began a project called Green Slopes. This project brings together representatives from New Hampshire, Vermont, Maine and Massachusetts ski facilities to talk about climate change impacts and put strategies into action to reduce emissions and water use at ski areas in the Northeast.

On July 24, 2008, the NHPPP and Ski NH collaborated on the second annual Green Slopes Workshop. This year's workshop focused on reducing energy consumption and increasing recycling rates at all ski facilities. The 2007 workshop introduced

idling reduction policies and prompted the use of biodiesel fuels. Participants at each of these workshops heard from research experts and representatives of ski areas that have become environmental leaders.

Many New Hampshire ski areas were introduced to the idea of "greening" their facilities through the Green Slopes project, while others were already leaders in the field. Cranmore Mountain has been using biodiesel in all of their grooming and fleet equipment since 2003, and seven facilities have followed in their footsteps, purchas-


ing 296,600 gallons of biodiesel instead of standard diesel for the 2007-08 ski season.

Ski facility managers prevented approximately 130 tons of carbon dioxide from being released into the atmosphere over the ski season, simply by turning off grooming vehicles.

In similar fashion, as of July 2008, 17 facilities have implemented idling-reduction policies for their employees and visitors. After analyzing the data from workshop questionnaires, ski facility managers prevented approximately 130 tons of carbon dioxide from being released into the atmosphere over the ski season, simply by turning off grooming vehicles. For the 2008-09 season, 14 facilities agreed to

set up recycling bins in their lodges and 15 have applied energy reduction policies to their Standard Operating Procedures. To see other projects that ski facilities in New Hampshire are involved in, visit the Green Slopes section of the N.H. Department of Environmental Services (DES) webpage, <http://des.nh.gov>.

In addition to building relationships like this, the NHPPP provides compliance assistance to ski facilities. Many New Hampshire facilities have asked the NHPPP to conduct site visits and provide a variety of information such as vendor contact lists and DES fact sheets. The 2009 Green Slopes Workshop will continue the push for decreasing the carbon footprint of ski facilities by focusing on aboveground storage tanks and creating a "Green Team", thus creating a more sustainable ski slope.

If you would like more information on the Green Slopes Project, please contact Tara Mae Goodrich at the NHPPP at nhppp@des.nh.gov or (603) 271-0878. 

Cannon Mountain is one of the ski facilities participating in the NHDES Green Slopes Project.



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Climate Change Poses New Challenges to our Waters

by Jody Connor, Limnologist,
Department of Environmental Services

Donana National Park, Spain, home to more than 70 percent of all European bird species, was the site of one of the largest bird mortalities in the world (Dixon, 2008). The incident started when a scum of cyanobacteria – a blue-green algae bloom – appeared on the lagoon. Days later, a large fish kill was documented and at least 6,000 waterfowl died. The birds likely died as a result of feeding on the dead fish. When investigators sampled the lagoon and birds, they found a toxin-producing cyanobacteria to be the cause of the deaths. Bioaccumulation occurred as the toxin, known as cyanotoxin, transferred to zooplankton, invertebrates, fish, and ultimately birds.

Recent years have shown growing anxiety about cyanotoxin threats. Health impacts have been recorded throughout the world with deaths of dogs, cows, donkeys, birds, fish, and at least one human. The key relationship in these deaths was the measurement of cyanotoxins within the victims and the presence of cyanobacteria scums in the water. Closer to home, in 2007, a dog had seizures after drinking water from a Henniker, N.H., lake that had a severe bloom of toxic cyanobacteria.

Cyanobacteria Features

Scums of cyanobacteria (algae blooms) are problematic from ecological, economic and health perspectives. Cyanobacteria are the oldest known photosynthetic organisms; they were first present some three billion years ago (Paerl, 2008). Their proliferation during this period is largely responsible for the production of atmospheric oxygen that paved the way for higher plant and animal life.



Cyanobacteria scums are becoming more common in New Hampshire lakes and ponds.

Cyanobacteria remain a remarkable evolutionary success story. Some genera have gas vacuoles to regulate their own buoyancy. Cyanobacteria need phosphorus to photosynthesize, and buoyancy control can come in handy when they need phosphorus. When they need sun to make chlorophyll, gas is produced to float to

the water surface; when they need phosphorus, they de-gas to sink to where there is an ample supply of nutrients.

Any increases in nutrients to a system can increase the numbers of cyanobacteria. When humans develop land, more impervious surfaces appear in a watershed.

Rooftops, roads, driveways, and parking lots are all examples of impervious surfaces.

Nutrients accumulate on these surfaces and do not penetrate to the soil, but instead wash off to the nearest body of water.

Cyanotoxins

The cause and reason for cyanotoxin production are currently under investigation. It is known that different species of cyanobacteria produce different cyanotoxins, while others produce no toxins.

Some species produce a toxin that is known to affect liver function. These toxins can severely damage the liver in elevated doses, but can also lead to cancer when exposure is increased over an extended period of time.

Other species produce nerve toxins that interfere with nerve function and may have almost immediate effects when ingested at high concentrations. Typically these toxins cause seizures and impact the nerve synapses.

The other known cyanotoxin is the skin toxin, which is associated with rashes.

*In 2003, the
N.H. Department of
Environmental Services
issued only one
cyanobacteria warning.
12 were issued
in 2008.*

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Take the Carbon Challenge!

Today's unstable energy prices make it more important than ever to use energy wisely. Additionally, the environmental consequences of energy use are significant. Energy use – specifically the burning of fossil fuels for electricity, transportation, and heating and cooling – accounts for the vast majority of carbon emissions warming the planet. By using energy wisely, residents throughout New Hampshire can reduce the amount of fuel burned, which translates directly into monetary savings and a smaller “carbon footprint” at the same time! A wide variety of resources is in place to help in these efforts.

A good place for any municipality to start is with the Environmental Protection Agency (EPA) New England's Community Energy Challenge. New Hampshire's Department of Environmental Services


(DES) has teamed up with EPA to promote this municipal energy efficiency program to help your city or town cut energy waste in municipal buildings, schools and wastewater treatment facilities. Towns that take the Challenge agree to assess the energy performance in all buildings, set reduction goals of 10% or more, and promote energy efficiency to citizens, businesses and organizations within their communities. EPA in turn provides free training and technical assistance on Energy

Star tools to help analyze building energy use and identify areas for improvements. Over 30 New Hampshire communities have already joined EPA's Community Challenge.

While local government has a strong role to play in this effort, individual actions are just as important. With roughly half of the greenhouse gas emissions coming from households, your family really can make

a difference. Follow these simple energy-saving actions to save money and reduce carbon emissions:

- Clean or replace filters on furnaces.
- Insulate hot water heaters and hot water pipes.
- Lower the thermostat setting, especially when everyone is asleep or away from home.
- Turn off lights and computers when not in use.
- Change to compact fluorescent lights.
- Drive just 10 fewer miles per week.

The New Hampshire Carbon Challenge, a UNH initiative, is a fun way to identify those actions that provide the best opportunity to realize these savings. The Challenge has developed a “carbon calculator,” which can engage your family in determining your carbon dioxide emissions while devising a strategy to lower your energy costs and reduce your household's emissions by 10,000 pounds. Check out the website today at <http://carbonchallenge.sr.unh.edu>. 

While local government has a strong role to play in this effort, individual actions are just as important.

N.H. Fish and Wildlife at Risk

By Eric Orff


While many of us might think of climate change as something that will happen in the future, there may already be some impact on New Hampshire fish and wildlife species. This state's hunters and anglers are already witnessing changes, according to a poll taken by the National Wildlife Federation. Nearly two thirds of New Hampshire sportsmen say they believe that global warming is occurring in the state, and fully a quarter of them say they have already seen changes in species or habitats.

One species at risk because of global warming is our native brook trout. Brook trout remain common in many of the perennial streams that flow in our wooded habitats. Water temperatures above 70°F are stressful to these native fish, however, and a temperature above 75°F would prove fatal. Fish and Game Department fisheries biologists are monitoring changes by sampling streams across the state to document the current distribution of native brook trout.

Brook trout are not the only species of concern to our biologists. In the New Hampshire Wildlife Action Plan, completed in 2007 to assess the risks facing wildlife, climate change was described as a major threat to nearly two dozen species and habitats. From the White Mountain Arctic butterfly on our alpine peaks to American marten and lynx in our spruce forests, and on down to common loons on our lakes and common terns along our coast, many species are at risk from global warming. A warming climate will also shift our forest types, with spruce and fir habitats lost as these species die out along their southern range. Even our black bears seem to be telling us to chill out. Mid-winter occurrences of bears raiding bird feeders are on the rise, as insomniac bears wander the winter away.

To learn more about the potential effects of climate change on our state's fish and wildlife, visit www.WildNH.com/Wildlife_Journal/WJ_mag.htm and

click on “Climate Change: Forecast for New Hampshire Wildlife” (*New Hampshire Wildlife Journal* January/February 2008); reprints are available by calling 603-271-2461.

To explore New Hampshire's Wildlife Action Plan, visit www.WildNH.com/Wildlife/wildlife_plan.htm. 



ANNOUNCEMENTS

N.H. Environmental Educators Annual Meeting

"Taking it to the Field; Building Inquiry Outdoors" is the theme of the NHEE annual meeting, which takes place on March 11 (snow date March 12), from 9 a.m. to 5 p.m., at the Peabody Mill Environmental Center, Amherst NH. A venue for formal and non-formal educators to learn about current issues facing teachers, explore strategies for getting students outside, network with fellow environmental educators and plan for the future. For more information, contact Jessica Morton at jmorton@metrocast.net or (603) 706-0291 or visit our website at www.nhee.org.

Project WILD and WILD Aquatic Workshop

Saturday, March 14, from 9:00 a.m. - 4 p.m. at N.H. Fish and Game headquarters, 11 Hazen Drive in Concord. Go

WILD in your classroom using this activity-based, supplementary curriculum; a great resource for teaching about wildlife and environmental concepts. To register or for more information, contact Mary Goodyear at mary.goodyear@wildlife.nh.gov or at 603-271-6649 by March 9. Visit www.WildNH.com.

Forests of the World Workshop

NH Project Learning Tree will hold a "Forests of the World" workshop for Middle/High School Teachers later this winter. This workshop will train educators in PLT's new secondary module, *Global Connections: Forests of the World* which was developed in partnership with the World Forestry Center. Date to be announced (mid-February or March). Visit www.nhplt.org for updates on workshops.

A Forest For Every Classroom

The Forest For Every Classroom program educates middle and high school teachers about forest stewardship issues and provides them with the tools to develop curricula that meet state education standards and that can be implemented using their local landscape, resources and community. This is a yearlong professional development opportunity that begins May 15-16, 2009, at the Hubbard Brook Experimental Forest in Woodstock, N.H. Participants will meet each season for a total of 11 days. Other dates include: August 6-7 and August 11-13, October 2009 (dates TBA), and February 2010 (dates TBA). The application deadline is Friday, March 13, 2009. For more information, visit www.nhplt.org or contact Sara Head at (603) 226-0160.

Project WET/Webfoot Workshop

Wetlands provide tremendous benefit to our environment, economy and general well-being. They are also powerful places in which to learn. Join Project WET and Ducks Unlimited for this one-day workshop to learn skills and methods for teaching about water, wetlands and waterfowl. You will participate in fun, hands-on activities from the Project Webfoot Educators Kit and the Project WET Curriculum and Activity Guide. Check

the NH Project WET website for more information at www.des.nh.gov, click on "A to Z List" and find "Project WET." Or, email Alicia Carlson at wet@des.nh.gov.

2009 Jr. Duck Stamp Contest

N.H. Fish and Game's Junior Duck Stamp Contest is open to artwork from K-12 students. Entries must be postmarked by March 16, 2009. Find entry forms and a curriculum guide for teaching conservation through the arts at www.WildNH.com/Education/ed_Junior_Duck_Contest.htm. For more information, contact Victor Young at victor.e.young@wildlife.nh.gov or call (603) 271-3211.

Wanted: District Science Leadership Teams

The Building Vertical Science Literacy program seeks to train, advise and support science teacher leaders at the district level to advocate for science literacy as envisioned in the NH Science Frameworks through environmental topics, inquiry and field investigations. The program is sponsored by the NH Education and Environment Team (Project WET, Project WILD, Project Learning Tree, Project HOME and GLOBE) and the Math Science Partnership.

This intensive staff development program will advise and support teacher leaders to reorient science teaching at their schools into a vertically aligned scope and sequence. This type of planning promotes inquiry science through questioning, field experiences, culminating activities and use of formative and summative assessment.

Participating teacher leaders will attend a summer institute and four to five days of professional development during the school year, as well as being a part of online discussions. Stipends for summer work and substitutes are provided. Consultants are available to work with the science leadership team. Participants, as well as other teachers in their districts, will receive intensive training and ongoing support in the nationally based curriculum projects.

This year's cohort will begin in April. It is expected that a district will have a team of at least five, including one administrator who will be expected to be at a portion of the training. If you are interested in finding out more, contact Erin Hollingsworth at erin@nhplt.org or Jiffi Rainie at the NH Department of Education, jenniferrainie@ed.state.nh.us.

WEB Resources:

- **Climate Ambassadors:**
www.epa.gov/climateforaction (resource for PreK-8's "The Global Climate," "Our Changing World," and "Publicize It!") The Environmental Protection Agency is launching a campaign to educate middle and high school students about climate change, its effects on children's health, and actions teens can take to reduce greenhouse gas emissions.
- **Intergovernmental Panel on Climate Change**
www.ipcc.ch
- **Climate Change Education**
www.climatechangeeducation.org
- **Earth and Sky radio shows on Climate Change and the Forests**
www.forestfoundation.org/cel_radio.html
- **EE Week Carbon Footprint Calculator designed for students**
<http://zerofootprint.net/youth/neew>
- **USEPA Climate Change and Health for Teens**
www.epa.gov/climateforaction
- **USEPA Climate Change Science**
www.epa.gov/climatechange/science
- **Weather-Environment Themes Monthly for grades 5-8**
www.earthgauge.net/kids/index

ON THE H.O.M.E. FRONT

Integrated Landscaping Sustains Schoolyard Habitats

Part II

by Marilyn Wyzga

When you shape a landscape to create a schoolyard habitat, you want it to do more than survive; you want it to thrive. Any landscape will be more successful when we follow nature's lead, responding to environmental conditions and taking our cues from this system that evolved over 3,500 million years. This approach, called "integrated landscaping," supports a wide variety of naturally occurring ecological services, including: filtering pollutants from air and water, preventing soil erosion, creating microclimates that buffer temperature extremes, soaking up rain and snowmelt water to reduce runoff, and moderating climate by producing shade and sunlight.

The following excerpt from the recently published, *Integrated Landscaping: Following Nature's Lead*, explains the second 5 of the 10 key principles. (The first 5 principles were printed in the last issue of *WEB News*.)

Ten Natural Principles to Guide Your Landscaping Practices

Integrated Landscaping uses local ecosystems as models, studying the fundamental processes of nature and applying them to the landscapes we create around our homes, workplaces, and public spaces. The following principles inherent in natural systems serve as both a framework and a justification for mimicking nature in our landscaping practices:

6. Diversity builds over time, keeping plant pests and diseases in check.

Natural systems sustain themselves as organisms live, grow, die, and decay together. Plant diseases that attack the plants in that system may appear and sometimes cause a species to weaken and die. When this happens in a diverse community, other species readily compete for the resources made available. Healthy natural systems invite enough diversity to ensure that populations of beneficial insects, birds, and mammals keep damaging pest species in check.

7. Plants supply fresh air above and below the ground, as well as cool shade.

Both fresh air and cool, moist soil promote growth of root systems and populations of microorganisms. Healthy root systems take in nutrients that enhance plant growth, increasing the amount of biomass (leaves, stems, fruit, etc.) above and below ground. Increased biomass manufactures more food, giving plants energy to increase the overall size. This cyclical action supplies fresh air and shade, which in turn promotes continuous functioning of the natural processes described above.

The growth and decay of plant roots creates passageways through the soil, improving both air and water drainage. Nutrients, carried by rainfall and pulled by gravity, travel through this intricate network. In a loose, permeable soil, gas exchange occurs readily, while nutrients travel deeper into the soil, building soil fertility reserves.

In natural systems, dense layers of vegetation from the canopy to the litter layers covering soils, provide fresh air and shade to the landscape. Water that infiltrates the soil is absorbed by roots and released through the leaves as water vapor (transpiration). Additional cooling occurs when water evaporates from soil, litter, and leaf surfaces.

8. The subsoil provides inorganic compounds required for living and nonliving processes.

In undisturbed natural systems, subsoil lies below the upper layers of soil. Formed by the weathering of parent material, the subsoil provides inorganic compounds (mineral matter) to the soils and plants above.

Systems with diverse plants and animals contribute to the upward movement of the

subsoil's minerals. For example, the large mound of soil at the entrance of a woodchuck hole and the much smaller mounds of ant hills are both examples of subsoil being brought to the surface where over time it will be incorporated into the litter layer and become part of the nutrient cycle.

9. Natural systems are dynamic and will change over time.

Natural systems undergo succession, the progressive change from one dominant plant community type to another. For example, naturally disturbed soil gets colonized by lichens, followed by grasses. An old field becomes a forest. Both plants and animals co-evolve as a system, and both modify and are modified by their environment.

Plants and animals change over time in natural systems. For example, as the canopy of a young tree expands, the branch density provides safety for a nesting bird. Shade-tolerant plants such as ferns may flourish beneath and as the tree begins to flower pollinating insects arrive, fruit forms, and the fruit matures to feed wildlife. Sun-loving plants find their way to the outside edge of the canopy's spread, where they find plenty of light. All the while, soils keep developing and improving.

10. Humans experience sensory, intellectual, emotional and spiritual stimulation, opportunities for learning, and insights into the wonder of complex natural processes.

Natural systems engage all our human senses.

Nature stimulates our intuition by providing places to reflect, relax, imagine,

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The Climate Change Factor

In addition to increased supplies of nutrients, climate change may be an important factor in increased measurements of cyanobacteria. In 2003, the New Hampshire Department of Environmental Services issued only one cyanobacteria warning. That number has steadily increased over the past five years; 12 cyanobacteria warnings were issued in 2008.

Rising temperatures favor cyanobacteria in several ways (Paerl, 2008). Cyanobacteria thrive at higher temperatures than other phytoplankton. Warmer weather conditions cause a lake to layer earlier in the spring and to mix later in the fall, lengthening the optimal growth period of cyanobacteria. Increased cyanobacteria on the lake surface also leads to the absorption of more sunlight and increased surface water temperatures.


Surface water warming strengthens the temperature layering of lakes, reducing the vertical mixing of the water. Buoyant cyanobacteria cells absorb and shade the sunlight from the more favorable phytoplankton, causing die-off. The food chain is altered when zooplankton and fish that depend on the favorable phytoplankton have a reduced food source.

Increased water temperatures are likely

contributing to an extension of the cyanobacteria geographical ranges. New cyanobacteria species found in tropical regions of the world are now on the move to the once cooler, higher latitude geographical areas.

Conclusions

Although humans have a profound and well-documented history of accelerating the eutrophication process (the aging of lakes through increased nutrient enrichment), there is an increasing connectivity between increased atmospheric CO₂, regional and global warming and increased cyanobacteria. The increase and the movement of cyanobacteria have serious consequences to the food chain, water supplies and recreation.

These developments have put forward a new set of challenges to scientists all over the world. Not only will scientists contend with reducing nutrient inputs to the waters, but now must also contend with a new set of rules dictated by climate change. 


References:

- Dixon, B. 2008. *A Global Challenge. Microbe* 3:394-395.
 Paerl, H. W. 2008. *CyanoHABS and Climate Change. LakeLine* 28: 29-33.

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inspire, hope, create, be still, be part of the great unknown and fathom the mysteries of life.

Natural systems also provide innumerable learning opportunities by serving as outdoor classrooms.

In all these ways, we reconnect with nature and recognize our place within it. Our natural landscapes remind us that we humans depend on the natural world for our own health and wellbeing. 

Excerpted from Integrated Landscaping: Following Nature's Lead, by Lauren Chase-Rowell, Kate Hartnett, Mary Tebo and Marilyn Wyzga; 2008. To order, visit www.WildNH.com/Shop/shop_books.htm.

Coordinator Information

Mary Goodyear Project WILD

N.H. Fish and Game Dept.
 11 Hazen Drive
 Concord, NH 03301
 (603) 419-0256 or
 (603) 271-6649
 mary.goodyear@wildlife.nh.gov
 www.WildNH.com



Alicia Carlson
 Project WET
 N.H. Department of
 Environmental Services
 29 Hazen Drive
 Concord, NH 03301
 (603) 271-4071
 wet@des.nh.gov
 www.des.nh.gov



Esther Cowles
 Project Learning Tree
 54 Portsmouth Street
 Concord, NH 03301
 (800) 677-1499
 info@nhplt.org
 www.nhplt.org



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NH Project Learning Tree
 54 Portsmouth St.
 Concord, NH 03301

